What's Your Speed?

QUITE some food for thought is offered in Ernest Welleck's article in a current issue of "Popular Science," entitled "What's Your Speed?" This question, as Mr. Welleck considerately points out, does not apply to your car (if you have one), but to your brain. The writer asks: "How promptly does your brain respond to impressions by muscular reaction?" And then he says:

"If you don't know, and the chances are you don't, go to Dr. Amar, in Paris, and let him find out for you. He will submit you to a few psychographic tests, and at their conclusion will tell you your speed to the hundredth part of a second. Incidentally, he will tell you whether you are fitted for the profession or occupation in which you are engaged or intend to become engaged.

"The apparatus that Dr. Amar uses is a psychograph of his own invention, a device for registering the promptness, intensity, duration, etc., of muscular responses to impressions received by eye, ear, or sense of touch of the person tested. The apparatus has a cylinder covered with paper coated with lampblack.

"This cylinder is revolved by clockwork at the rate of one revolution a second. A vibrating needle, which makes one hundred double vibrations a second, marks a wavy line that serves as time measure for minute fractions of a second upon the blackened paper. The muscular reactions of the subject tested are transmitted by air pressure to two needles, which mark a record of these reactions on the cylinder.

"Dr. Amar will seat you in front of a table equipped with the testing apparatus. Directly before you are two little pneumatic drums. When you have received your instructions you place a finger upon the membrane of one of the little drums, your eyes focussed on something that resembles a small camera.

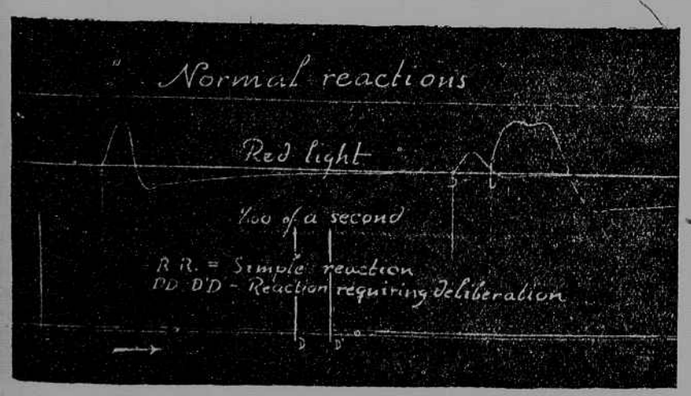
"A few minutes later a touch of the doctor's finger upon the shutter releases allows a flash of the electric light in the box behind the lens to reach your eye. At the same moment—so it seems to you—you press your finger upon the drum head. The air pressure in the drum simultaneously causes a needle to mark a line, more or less curved, on the lampblack covered paper.

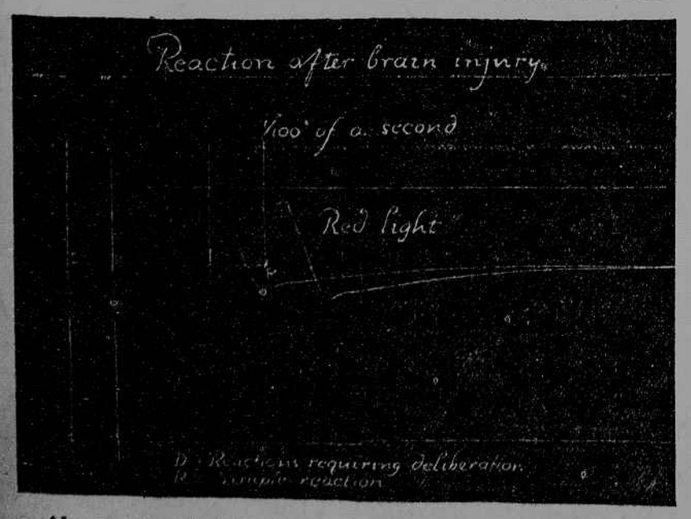
"Then the paper is taken off the cylinder. Here is the mark of the doctor's signal and there is the record of your reaction. The doctor counts the number of waves of the vibrating needle on the paper and informs you that 20/100 of a second elapsed between the signal and your response. And you imagined your pressure to have been simultaneous with the signal!

"You are assured that your brain functions normally—that the time for simple visual reactions in normal subjects averages between 0.195 and 0.21 seconds.

"In the tests for reactions involving deliberation the same device is used. You place one finger of the left hand on one of the little drums, one finger of the right hand on the other drum. You are informed that the left drum means blue, the right drum red. The doctor flashes a red or a blue light through the lens of the camera-like device, and you signal back the impression by pressing the right or the left drum-head. On examining the record on the cylinder you find that it took you more than twice as long to react in this visual test as in the simple visual test in which you were not called upon to decide whether the light was red or blue.

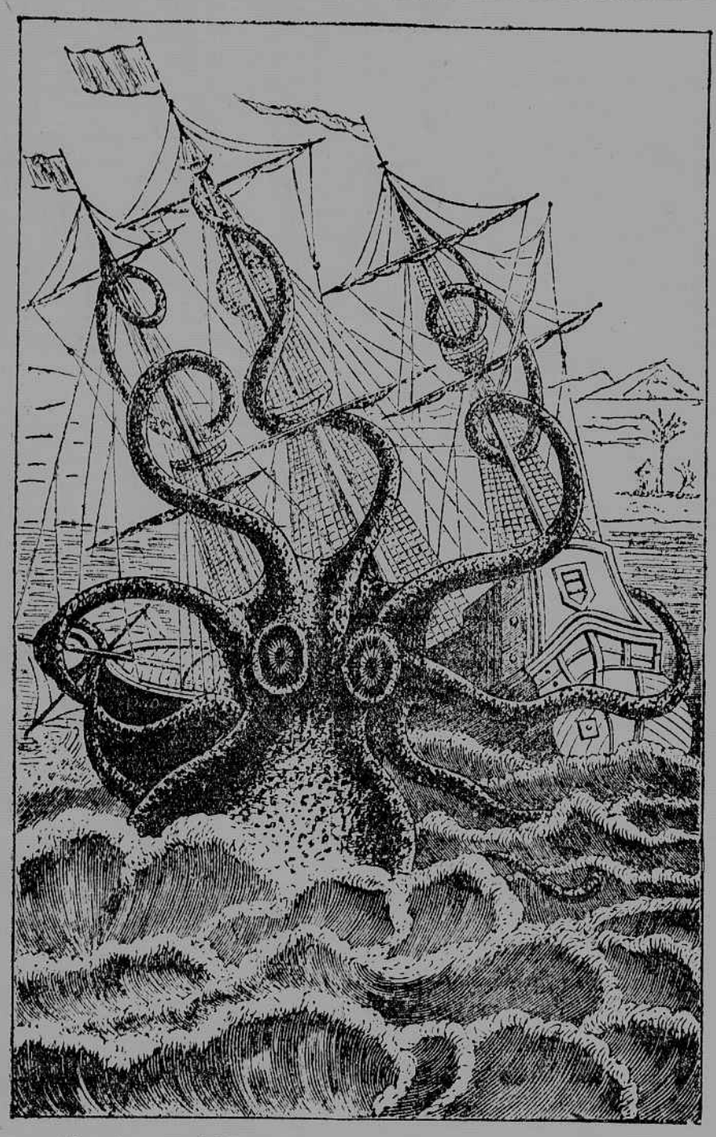
"The statistical material so far collected shows that the age of the subject, between the limits of eighteen and forty-five years, does not materially affect the time of simple reactions. Subjects whose occupation demands alertness—for instance, designers, typists and mechanics—react more promptly than farmers, who are invariably slower by 0.02 seconds or more. The records of persons who have sustained injuries of the brain, or who have been operated on because of such injuries, show much higher figures: 0.32 seconds for visual signals, 0.24 for sound signals and 0.21 for touch signals represent the average for that class of invalids."





Above, a record of the simple reaction to a visual signal and of reactions requiring deliberation by a normal person; and, below, a record of similar tests on a young coppersmith whose brain has been injured. —From *Popular Science Monthly.*

Did Gargantuan Squids Devour the Cyclops?



The giant cuttlefish, the "Poulpe Colossal," described by De Montfort, supposed by ancients to cause the disappearance of ships —From *The National Marine*

DESPITE the exhaustive search by the United States navy of every nook and corner of the Caribbean, the loss of the naval collier Cyclops still remains a mystery. The usual explanations for the loss of a vessel last seen almost a year ago, sailing apparently under perfect control with a complement of 295 men and with such a modern appliance as the wireless, do not suffice for the collier's disappearance. If a prize of a German raider, it would have been learned by now; if a victim of a German submarine, wreckage would have been found; which is true also if the vessel had struck one of those uncharted rocks. Was the Cyclops, notably a top-heavy ship, sunk without all trace by foundering in one of the heavy tropical storms? Or shall the theory be accepted which George Noble advances in "The National Marine" that the Cyclops has sailed away to join those other seventeen ships of our navy which have disappeared just as mysteriously since 1781?

Mr. Noble writes:

"About the only possible explanation incapable of contradiction is that Gargantuan Squids—monster cuttlefish—treated of in fiction and in fact, may have reared themselves out of the sea and, instead of winding their tentacles around the hulls and rigging and crushing the structure to matchwood before dragging it to their lair at the bottom, may have helped themselves to the ship's people as delicately and effectually as one plucks gooseberries off a bush—then sunk out of sight and left scarcely a ripple behind.

"The history of the ancient belief in the existence of gigantic cephalopods is somewhat obscure. All we know of it is in passages in the works of a few old Greek and Latin authors and a series of Scandinavian traditions.

"Eric Pontoppidan, Bishop of Bergen, is generally regarded as the inventor of the fabulous Kraken, and is constantly misquoted by writers who have never read his history of Norway.

"But fifty years or more before Pontoppidan, Christian Francis Paullinus, who was born in 1643, a physician and naturalist of Eisenach, had described a monstrous animal which occasionally rose for plunder along the coasts of Lapland and Finmark—so enormous that a regiment of soldiers could conveniently manœuvre on its back.

"Less conscientious and more credulous than the Norwegian episcopal advocacy is the testimony of Denys De Montfort, nigh a century later, beside whose 'Colossal Poulpe,' the gigantic and predatory animal described in the classics by Pliny was a mere pigmy.

"De Montfort gravely declared that six men-o'-war captured from the French by Admiral Rodney in the West Indies April 12, 1782, together with four British ships detached from the fleet as a convoy, were suddenly engulfed by colossal cuttlefishes. He also records a statement of Captain Jean Magnus Deus, by repute a respectable and veracious man, a trader to China, of an instance when the captain was becalmed and having his vessel's bottom painted while crossing from St. Helena to Cape Negro.

"The story runs that three men were standing on planks slung over the side when an enormous cuttlefish rose from the water and threw one of its arms around two of the sailors, whom it tore away with the scaffolding on which they stood. With another arm it seized the third man, who held on tightly to the rigging and screamed for help. His shipmates ran to his assistance and succeeded in rescuing him by cutting away the creature's arms with axes and knives, but he died delirious on the following night. The captain tried to save the other two sailors by killing the animal, and drove several harpoons into it, but they broke away, and the men were carried down by the monster. The arm cut off was said to have been twenty-five feet long and as thick as the mizzen yard and to have had on it suckers as big as saucepan lids.

"The means of observation on the duration of growth and life in the cephalopods have been difficult to obtain. From watching the rate of increase of size in young specimens De Ferussac, D'Orbigny and other naturalists have arrived at the conclusion that they sometimes live for many years and continue to grow till the end of their lives. That some, therefore, attain to a considerable magnitude is hardly surprising.

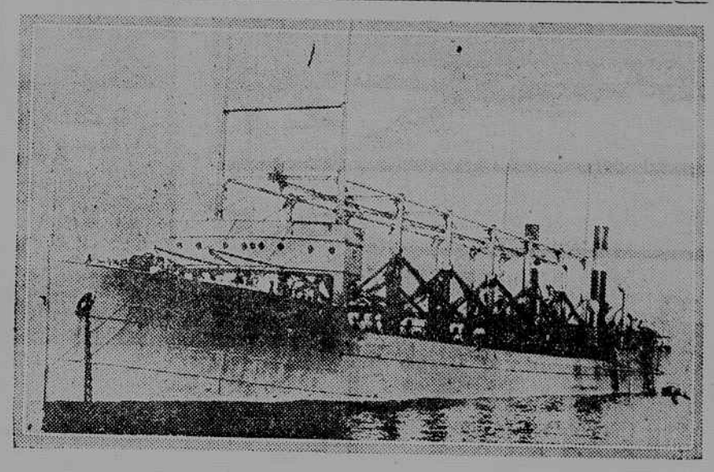
"Molina, in his 'Natural History of Chili,' describes among his other species of cuttlefish one, Sepia tunicata, of which specimens, armed with hooks in their suckers, weighed 150 pounds.

"Gwyn Jeffreys, in 'British Conchology,' talks of a huge cephalopod, stranded in the '60s between Hillsway and Scallaway, on the west coast of Shetland, of which the tentacles were sixteen feet long and the pedal arms about half that length. The largest suckers were three-quarters of an inch in diameter.

"To the Paris Academy of Sciences was reported a huge squid, met November 30, 1861, between Madeira and Teneriffe, and stated by the officers and crew of the French dispatch steamer Alecton to be of a deep red color and from sixteen to eighteen feet long without reckoning the formidable arms. Harpoons thrust into the beast drew out of the soft flesh. A rope with a running knot was slipped over it and held at the juncture of the fins, but when the men tried to haul the creature on board its enormous weight caused the rope to cut through the flesh.

"But we are not left dependent on documentary evidence alone. Cuttlefish of extraordinary size are preserved in museums at Copenhagen and at Marseilles. In November, 1874, the Rev. M. Harvey, a Presbyterian minister of St. John's, Newfoundland, got possession of a squid, or calamary, as the English sometimes call them, which three fishermen found entangled in their herring net in Logie Bay, about three miles from St. John's.

"The body of this specimen was more than seven feet long and the caudal fin was twenty-two inches broad. The two tentacular arms were twenty-four feet long each and the eight shorter arms six feet long each, the largest of the latter being ten inches in circumference at the base. What couldn't such a monster do!"



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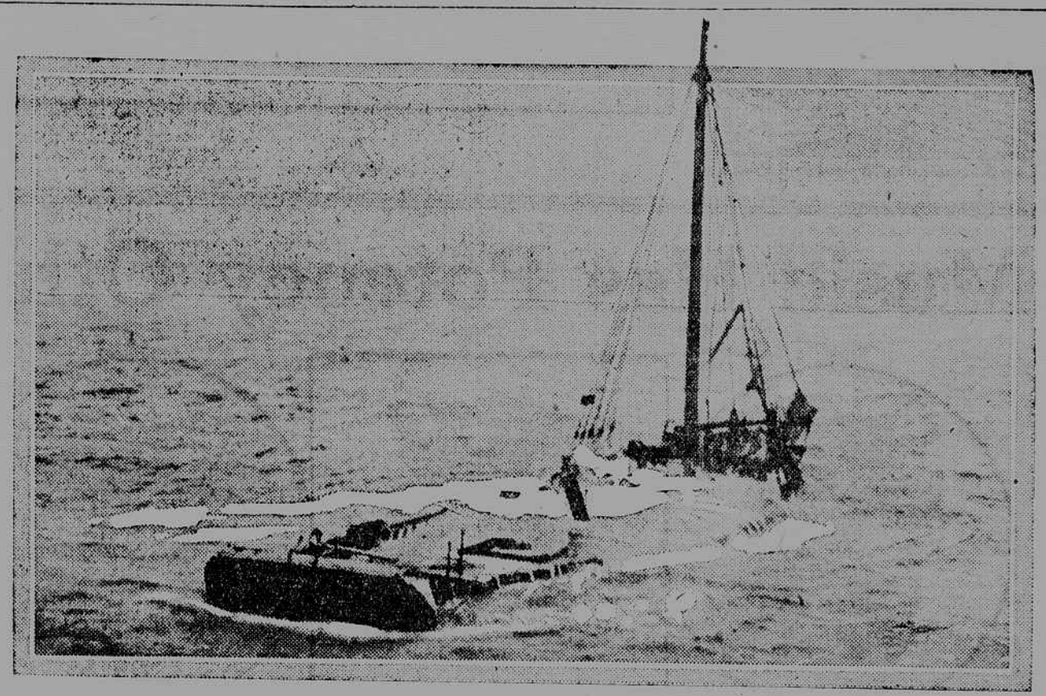
The navy collier Cyclops, which disappeared last March, is generally supposed to have foundered in a severe tropical storm



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The derelict accounts for many a ship's disappearance

The Chameleon: Science

SCIENCE, declares Professor George T. W. Patrick in "The Scientific Monthly," has vindicated itself in its practical applications. Considering science in its relationship to the Great War and to the Great Peace, the writer says:

"In this connection we are reminded that there is one field in which science has distinguished itself beyond all others, and that is in the art of war. To the exquisite perfecting of this art every science has been called upon to contribute its very best and latest results—mathematics, engineering, physics, chemistry, metallurgy, mechanics, optics, radio-activity, electro-dynamics, aeronautics, economics, zoölogy, psychology and many others. An immeasurable weight of the best and keenest thought of the world has been expended in the application of science to the paraphernalia of war, resulting in an amazing progress in the development of this art to the highest conceivable degree of perfection.

"If in defence of this kind of application of science one should say that by this art civilization has been saved, it would only be because by this art it was threatened. Given an unscrupulous nation dreaming of world dominion and harassed by the need of commercial and industrial expansion, that nation would never have dared to venture on this ambitious project had it not been for the fact that she found herself in possession of such an arsenal of cunning devices as to make success apparently certain; submarines and superdreadnoughts, mines and torpedoes, airplanes and monster dirigibles, titanic cannon and marvellous machine guns, secret formulæ for super-explosives, poison gases and liquid fires—these are some of the implements of war which applied science had put into her hands.

"The results, whether one choose to regard them in terms of sorrowing homes, of outraged and degraded morals, of the loss of the best young blood of all the nations, of enslaving national debts, of the disorganization and ruin of world commerce and industries, or of the destruction of art treasures, are equally appalling.

"If, as many believe, one of the prominent causes of the war was the urgent need which Germany felt for commercial and industrial expansion, we seem in this very fact to have an indictment of the mechanic and industrial arts, when viewed in the light of the leading motive in the social order. Nowhere else in the world had science been applied so extensively and successfully to the satisfaction of human wants as in that country. Yet these wants were not satisfied and Germany had to fall back on the age-old method of the exploitation of other nations. But we are evidently coming to the time when this method will not work. Perhaps it may be a long time before it will again be tried. Each nation must satisfy its own wants by peaceful means, and thus the question faces us whether any possible development of the mechanical and industrial arts, upon which we rely so fondly, will satisfy the desires of man.

"In former times wars acted to purify racial stocks by eliminating weak races. Modern wars have precisely the opposite effect, owing to the fact that a modern war kills or disables the best young men of all the warring nations, and so, by destroying the most valuable germ-plasm of the race, causes irreparable damage to society. Applied science has devised every conceivable means to make the destruction complete. Would it not be well, therefore, in the years to come for science to apply itself directly to the problem of preventing wars? It is idle to say that they cannot be prevented or that science has nothing to do with this problem. It lies distinctly within the field of such sciences as biology, psychology, sociology and education. For applied psychology it offers a most alluring field. It may be an immense problem, but the possibilities of science are immense."

Correspondence

Tesla answers Mr. Manierre and further explains the axial rotation of the moon

SIR:

In your article of February 2 Mr. Charles E. Manierre, commenting upon my article in "The Electrical Experimenter" for February, which appeared in The Tribune of January 26, suggests that I give a definition of axial rotation.

I intended to be explicit on this point, as may be judged from the following quotation: "The unfailing test of the spinning of a mass is, however, the existence of energy of motion. The moon is not possessed of such vis viva." By this I meant that "axial rotation" is not simply "rotation upon an axis" as nonchalantly defined in dictionaries, but is a circular motion in the true physical sense—that is, one in which half the product of the mass with the square of velocity is a definite and positive quantity.

The moon is a nearly spherical body, of a radius of about 1,081.5 miles, from which I calculate its volume to be approximately 5,300,216,300 cubic miles. Since its mean density is 3.27, one cubic foot of material composing it weighs close to 205 pounds. Accordingly, the total weight of the satellite is about 79,969,000,000,000,000,000 and its mass 2,483,500,000,000,000,000 terrestrial short tons. Assuming that the moon does physically rotate upon its axis, it performs one revolution in 27 days 7 hours 43 minutes and 11 seconds, or 2,360,591 seconds. If, in conformity with mathematical principles, we imagine the entire mass concentrated at a distance from the centre equal to two-fifths of the radius, then the calculated rotational velocity is 3.04 feet per second, at which the globe would contain 11,474,000,000,000,000,000 short foot tons of energy, sufficient to run 1,000,000,000 horsepower for a period of 1,323 years. Now, I say that there is not enough of that energy in the moon to run a delicate watch.

In astronomical treatises usually the argument is advanced that "if the lunar globe did not turn upon its axis it would expose all parts to terrestrial view. As only a little over one-half is visible it must rotate." But this inference is erroneous, for it only admits of one alternative. There are an infinite number of axes besides its own on each of which the moon might turn and still exhibit the same peculiarity.

I have stated in my article that the moon rotates about an axis, passing through the centre of the earth, which is not strictly true, but does not vitiate the conclusions I have drawn. It is well known, of course, that the two bodies revolve around a common centre of gravity which is at a distance of a little over 2,899 miles from the earth's centre.

Another mistake in books on astronomy is made in considering this motion equivalent to that of a weight whirled on a string or in a sling. In the first place, there is an essential difference between these two devices though involving the same mechanical principle. If a metal ball attached to a string is whirled around and the latter breaks an axial rotation of the missile results which is definitely related in magnitude and direction to the motion preceding. By way of illustration: If the ball is whirled on the string clockwise, ten times a second, then when it flies off it will rotate on its axis twenty times a second, likewise in the direction of a clock. Quite different are the conditions when the ball is thrown from a sling. In this case a much more rapid rotation is imparted to it in the opposite sense. There is no true analogy to these in the motion of the moon. If the gravitational string, as it were, would snap, the satellite would go off in a tangent without the slightest swerving or rotation, for there is no momentum about the axis and, consequently, no tendency whatever to spinning motion.

Mr. Manierre is mistaken in his surmise as to what would happen if the earth were suddenly eliminated. Let us suppose that this would occur at the instant when the moon is in opposition. Then it would continue on its elliptical path around the sun, presenting to it steadily the face which was always exposed to the earth. If, on the other hand, the latter would disappear at the moment of conjunction, the moon would gradually swing around through 180 degrees and, after a number of oscillations, revolve again with the same face to the sun. In either case there would be no periodic changes, but eternal day and night, respectively, on the sides turned toward and away from the luminary.—NIKOLA TESLA.

Via Dynamite

THE UTILITY of dynamite in restoring the orchards of France to the flourishing and fruitful state they enjoyed before the advent of the Hun has been advanced by André Piédallu, and is described as follows in the February issue of "The Scientific American":

"The process consists essentially in using dynamite for the double purpose of breaking up the earth and securing an intimate mixture of the required fertilizers with it. The author had noticed the specially vigorous development of wild plants around the edges of old shell holes and old trenches which had suffered from heavy firing. He attributed this vigor of growth partly to the fissuration of the soil and partly to its impregnation with nitrogenous subjects. This view was supported by some experiments made several years ago in the western part of the United States, in which two-year-old cherry trees planted in holes excavated by dynamite reached the height of three metres (about 10 feet), while similar specimens planted by a spade remained spindling and grew scarcely half as tall.

"M. Piédallu applied his idea by placing a suitable amount of fertilizer in a container surrounding the explosives, in such a way that the force of the explosion would drive the former into the minute cracks produced, thus forming an ideal medium for the growth of the young tree. The formula of the explosive is not given, but it is stated that it is not affected either by concussion or dampness, is capable of being moulded, is completely free from chlorates (which might injure vegetation), is highly energetic in small volumes, and cannot be detonated except by a fulminating cap. The fertilizers employed are chosen with special reference to the character of the earth and the needs of the trees to be planted.

"The compressed fertilizer moulded around a nucleus of the explosive is placed in the bottom of a tube of celluloid, paper or cardboard. The cylinder of explosive, which contains a cavity for the fulminating charge, is then placed in the top of the tube, the hole being closed by a stopper pierced by a hole through which passes (fitting tightly) a piece of Bickford cord connected with the cap. Both the explosive charge and the mass of fertilizer adjoining it are covered with paraffin. The application of the charge is very simple and is said to save both time and labor. A hole like one used for placing a mine is bored with a pointed stick or iron rod, somewhat larger in diameter than the cartridge. This hole should be 60 centimetres deep (about 2 feet.)

"The explosion produces a spheriodal cavity some 80 centimetres in depth (about 30 inches.) The earth absorbs the vapors liberated and the young tree is then placed in the hole and its roots covered with the earth."

Old Timber for New Ships

A writer in "The Boston Globe" submits the following as an interesting sidelight on America's great shipbuilding industry:

"According to the rings of the stumps of big oaks cut at Winnegance, Me., this season for shipbuilding, a number of the trees were from 100 to 125 years old, and some had been growing for 150 years. The Morse sawmill at Winnegance has been operated for more than 100 years. The original frame of the mill is still there, as sound as ever, some of the hewn sticks of timber being eighty feet in length."

Zeppelin Flight to East Africa

Information regarding a remarkable flight of a German Zeppelin has recently been reported by a British correspondent who learned the facts since the coming of peace. A German airship, it is said, left Bulgaria carrying a crew of twenty-two men, tons of munitions, and medical supplies, bound for German East Africa, which is approximately 3,000 miles from Bulgaria. According to the account, while the ship was flying over Khartum, it received a wireless message ordering it to return, the Germans having learned that the majority of their troops in their African territory had surrendered.—From *Popular Mechanics.*

X-Ray

"VARIOUS types of X-ray apparatus were developed and used in the army during the war with the most gratifying results," declares an editorial in "The Army and Navy Register," which continues:

"Each type was subjected to the most thorough tests in actual service and proved its usefulness. Special mention should be made of the portable set which was installed in a motor ambulance and moved expeditiously to the advanced lines, where it rendered inestimable service to the surgeons. Of equal value has been the bedside set, a small, portable affair, which can be carried by a hospital attendant or rolled on casters directly to the cot of a patient. This set has been utilized on a large scale in the treatment of influenza and pneumonia cases; in Walter Reed Hospital 4,000 patients suffering with the epidemic have been photographed, the pictures being taken without disturbing the patient in the slightest degree. The value of the X-ray in the treatment of pneumonia has been amply demonstrated and there is no doubt that the use of these handy sets will be further extended. They are already in active use at Hospital No. 14, Fort Oglethorpe, Ga.; at Camp Devens, Camp Lewis and various other places with excellent results. At Camp Lewis a record in examinations was made which has probably never been exceeded; no less than 40,000 exposures were made of which 14,080 were chest cases. All previous records were broken in the number, as well as the promptness of examinations to detect, not merely the presence of disease, but of foreign bodies, of broken parts, etc. Both these X-ray sets are purely American inventions, developed entirely by Americans. An achievement in which the officials responsible for it take pride is the fact that not a man serving in the American army in France who needed an X-ray examination failed to get it and within a very short space of time."